July 24, 2017

Programmable Cyberinfrastructure

Introduction to building Clusters in the Cloud

Speakers

- Eric Coulter
  - Indiana University, XCRI Engineer
- Jeremy Fischer
  - Indiana University, Senior Technical Adviser, Jetstream
- Rich Knepper
  - Cornell University, XCRI Manager
- Francesco Pontiggia
  - Harvard University, Campus Champions Fellow

What is Jetstream and why does it exist?

- NSF's first production cloud facility
- Part of the NSF eXtreme Digital (XD) program
- Provides on-demand *interactive* computing and analysis or persistent services such as gateways
- Enables *configurable* environments and *programmable cyberinfrastructure*
- User-selectable library of preconfigured virtual machines
- Focus on ease-of-use, broad accessibility
- Will support persistent gateways (SEAGrid, Galaxy, GenApp, and others)
- Reproducibility: Share VMs and then store, publish via IU Scholarworks (DOI)

Jetstream
http://jetstream-cloud.org/

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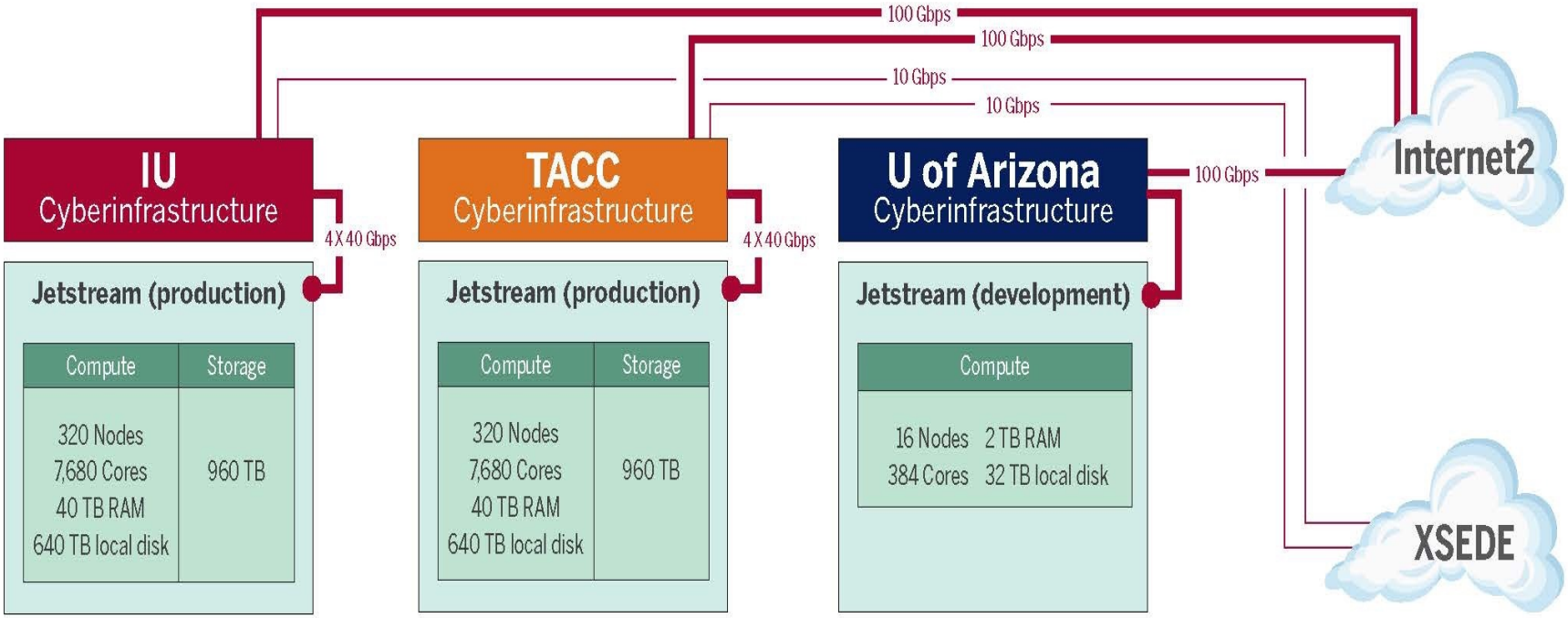
Jetstream System Overview



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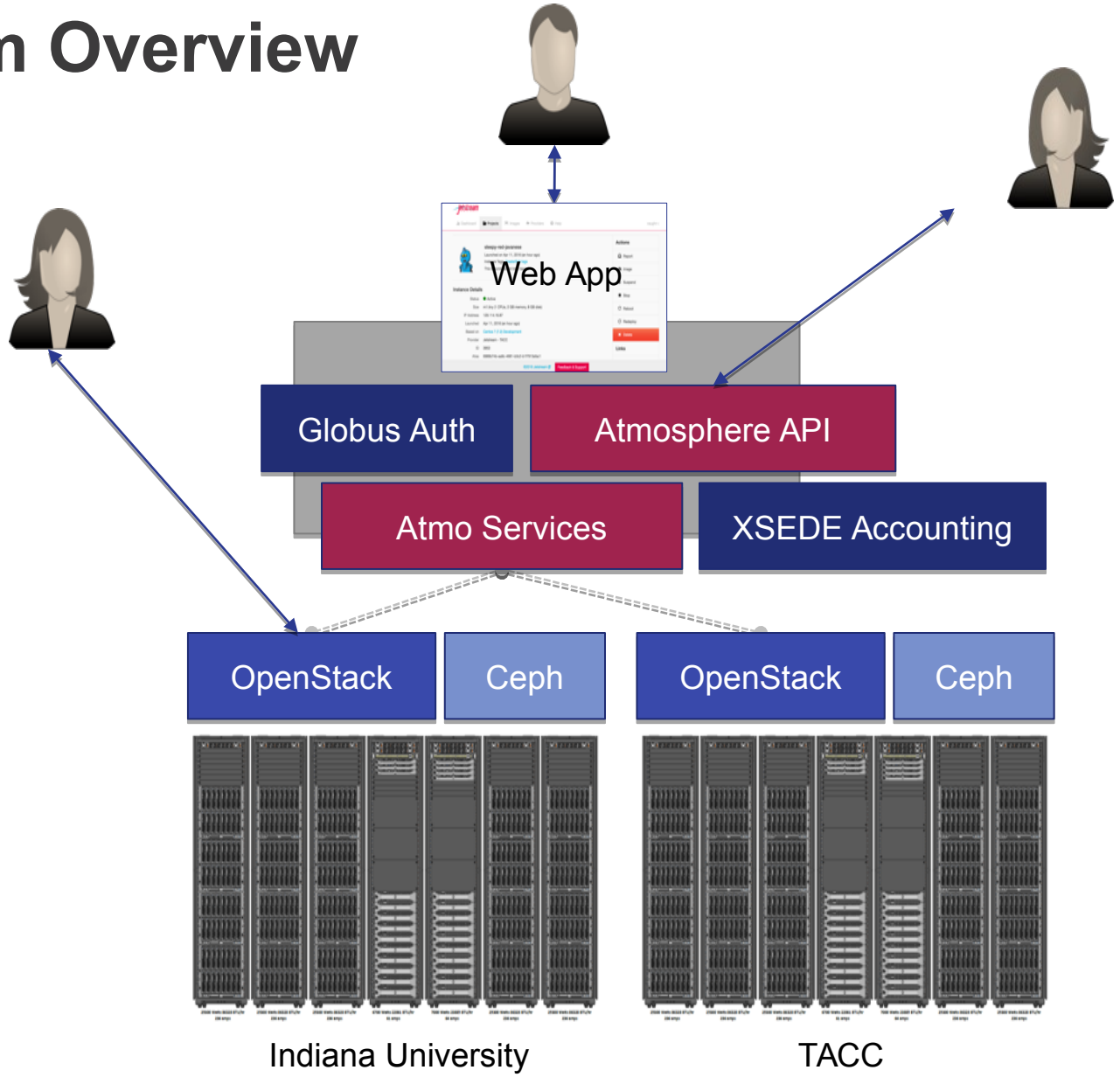
Platform Overview



Hardware and Instance ”Flavors”

VM Host Configuration

- Dual Intel E-2680v3 “Haswell”
- 24 physical cores/node @ 2.5 GHz (Hyperthreading on)
- 128 GB RAM
- Dual 1 TB local disks
- 10GB dual uplink NIC
- Running KVM Hypervisor

- Short-term *ephemeral* storage comes as part of launched instance
- Long-term storage is XSEDE-allocated
- Implemented as OpenStack Volumes
- Each user can get 10 volumes up to 500GB total storage*

Flavor	vCPUs	RAM	Storage	Per Node
m1.tiny	1	2	8	46
m1.small	2	4	20	23
m1.medium	6	16	60	7
m1.large	10	30	60	4
m1.xlarge	24	60	60	2
m1.xxlarge	44	120	60	1
s1.large**	10	30	120	4
s1.xlarge**	24	60	240	2
s1.xxlarge**	44	120	480	1

** s1.* based instances are not eligible to be saved into a customized image

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The basics that Jetstream provides

- Base images to start from (JS-API-Featured-*)
- A basic network space (some DIY required)
- An IP pool
- Isolated project space for your team (on two clouds)
- A blank canvas (to some degree) – you can truly install just about anything you want – and you can BYOLicense if needed

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Jetstream storage

Storage built into the VM flavors = ephemeral (replicated, but…)

Volume storage = persistent (erasure coded, 4 data 2 recovery)

Valuable data should be on volumes (and backed up elsewhere)

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Thinking about VMs…

Cattle, not pets: pets take great amount of care, feeding, and you name them; cattle you intend to have high turnover and you give them numbers.

-- George Turner (Jetstream architect)

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Left Twix, Right Twix

- Having two clouds = some semblance of fault tolerance
- Making that work for your gateway
  - Fail over possibilities
  - Load distribution/performance
  - Maximizing simultaneous VMs (VM/IP limits per cloud)

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But what about big data sets and such?

- At IU, Wrangler is nearby
- Jetstream wired to Wrangler's switch and vice versa
- Dedicated NFS node(s) on Wrangler for Jetstream
- Dedicated vlan built for projects that need access (still in beta, but working!)
- Hoping to replicate at TACC soon-ish

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What is XCRI? (XSEDE Cyberinfrastructure Resource Integration)

- We still bridge campuses!
- XCRI provides software toolkits to ease use of local resources, and facilitate easy transitions between local and XSEDE resources
- We also do site visits and remote consultation!
- Continually looking for feedback from XSEDE users, Campus Champions, and service providers to keep our offerings up-to-date with current needs

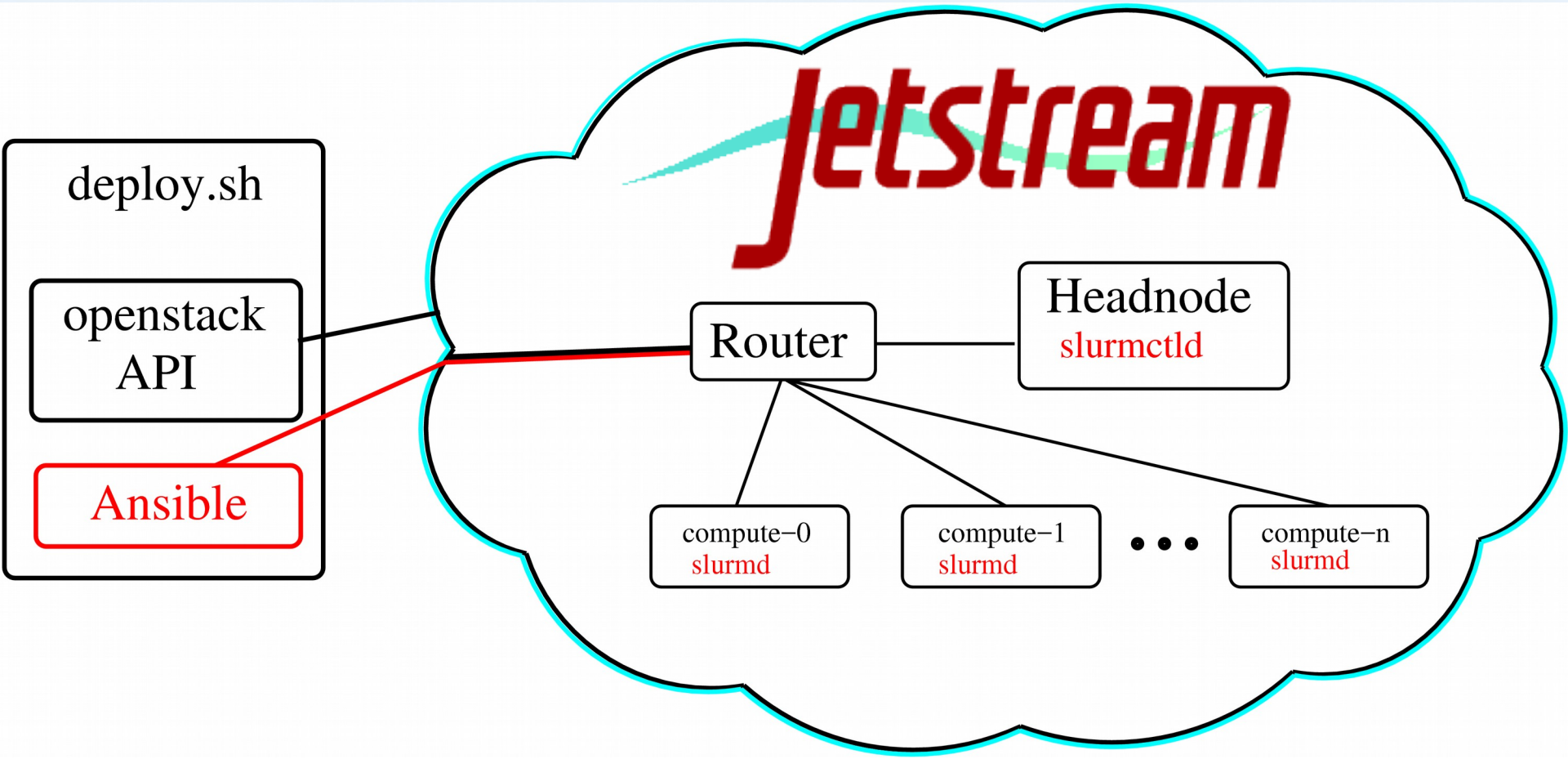
XCRI Toolkits

- XCBC
  - Build a cluster based on OpenHPC
- XNIT
  - Get open-source scientific software
- Globus Connect Server configuration management
  - Easily set up a local globus connect server using Ansible
- Jetstream Virtual Clusters
  - Build a cluster in Jetstream, with Openstack and Ansible
- Upcoming:
  - Cluster Monitoring toolkit
  - Data science / Humanities packages

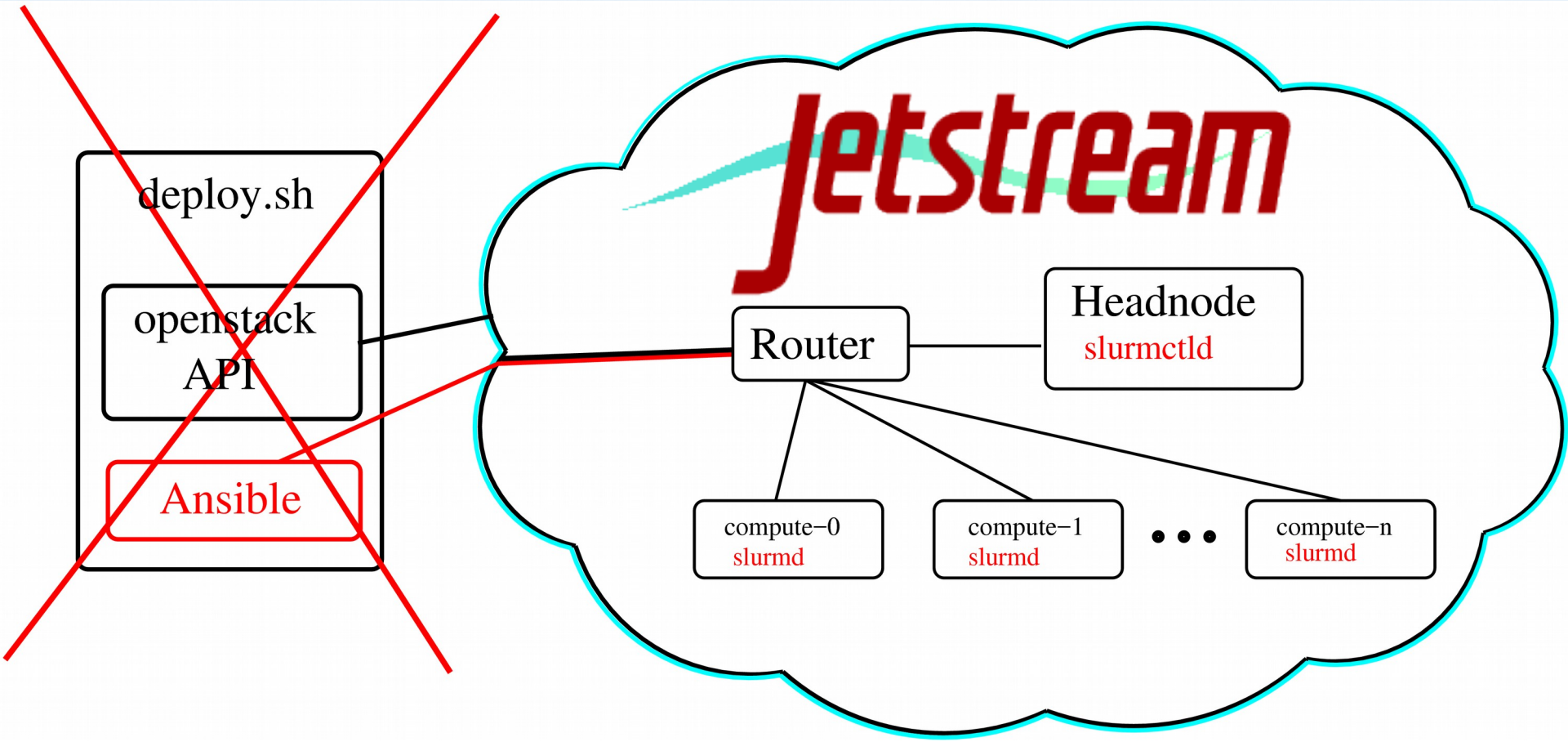
Jetstream Virtual Clusters

- Inspired by a need for more resources on Science Gateways
- Science Gateways allow users to submit jobs through a web interface, to a variety of resources – local, XSEDE, or cloud.
- The Airavata middleware developed by the SGRC (Science Gateways Research Center at Indiana University) makes these easy to build
- This model of virtual cluster was specifically developed for the SEAGrid project, available and easily configurable for anyone else.

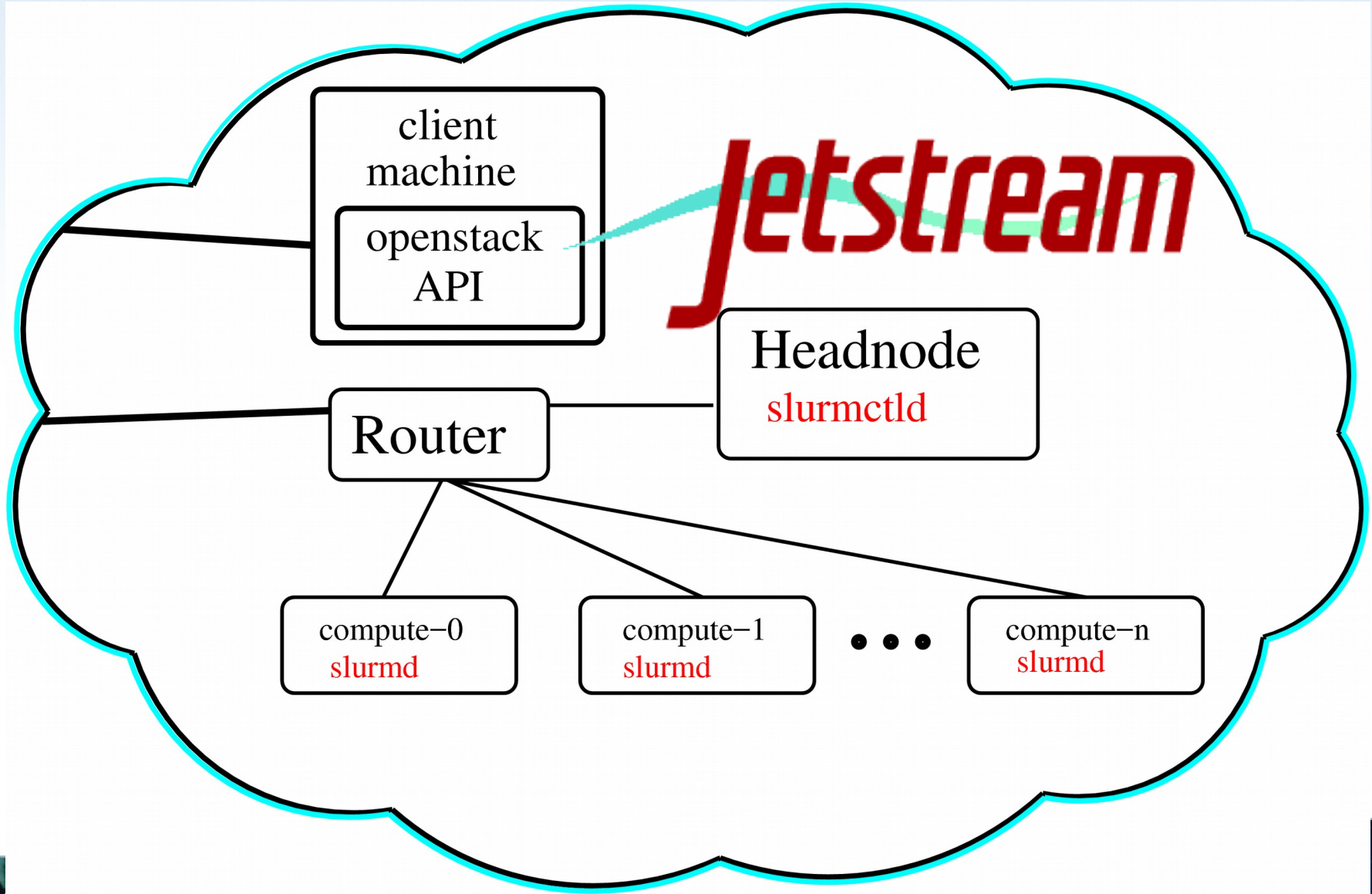
Jetstream Cluster Overview



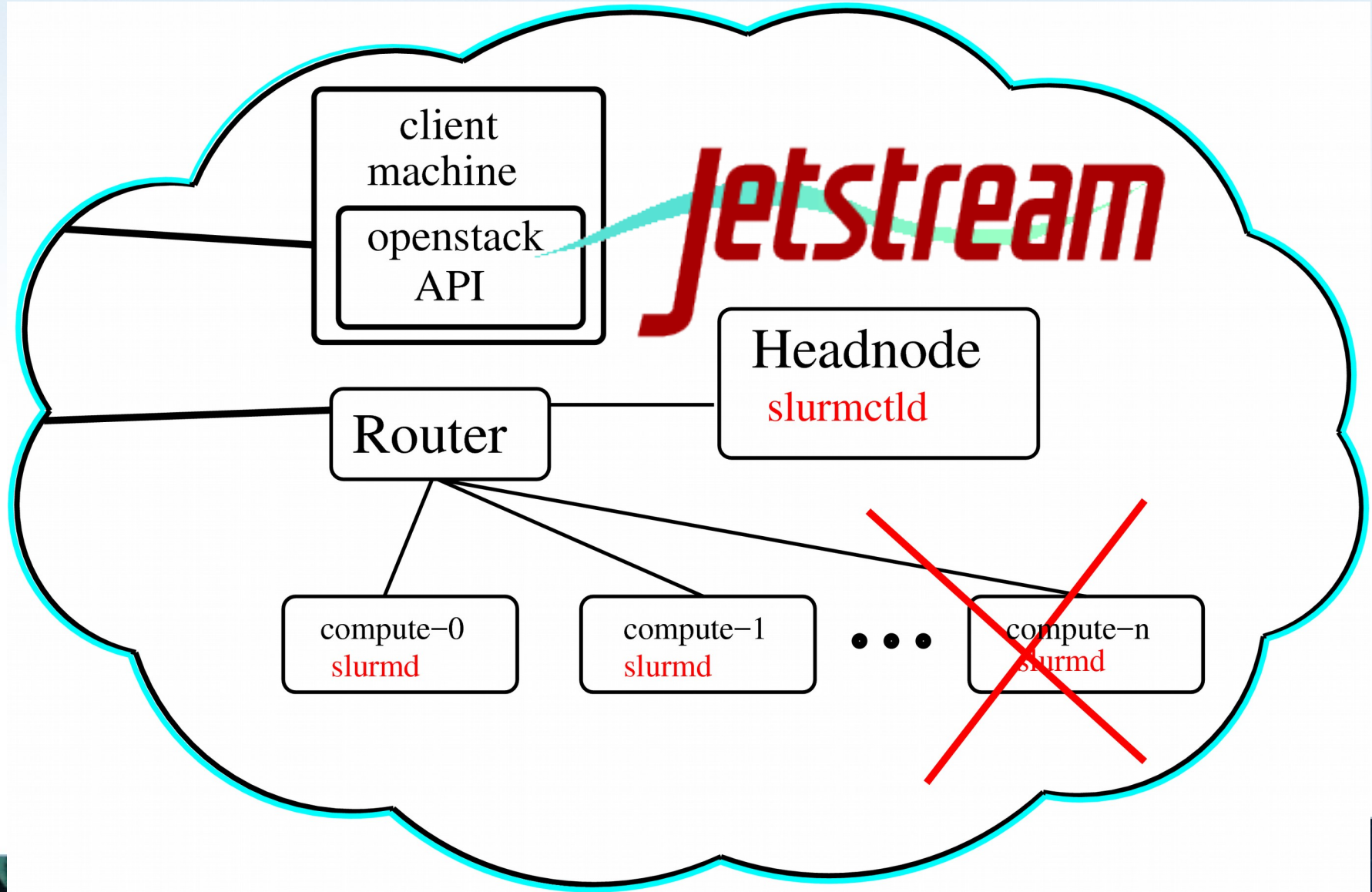
We're not using Ansible today!



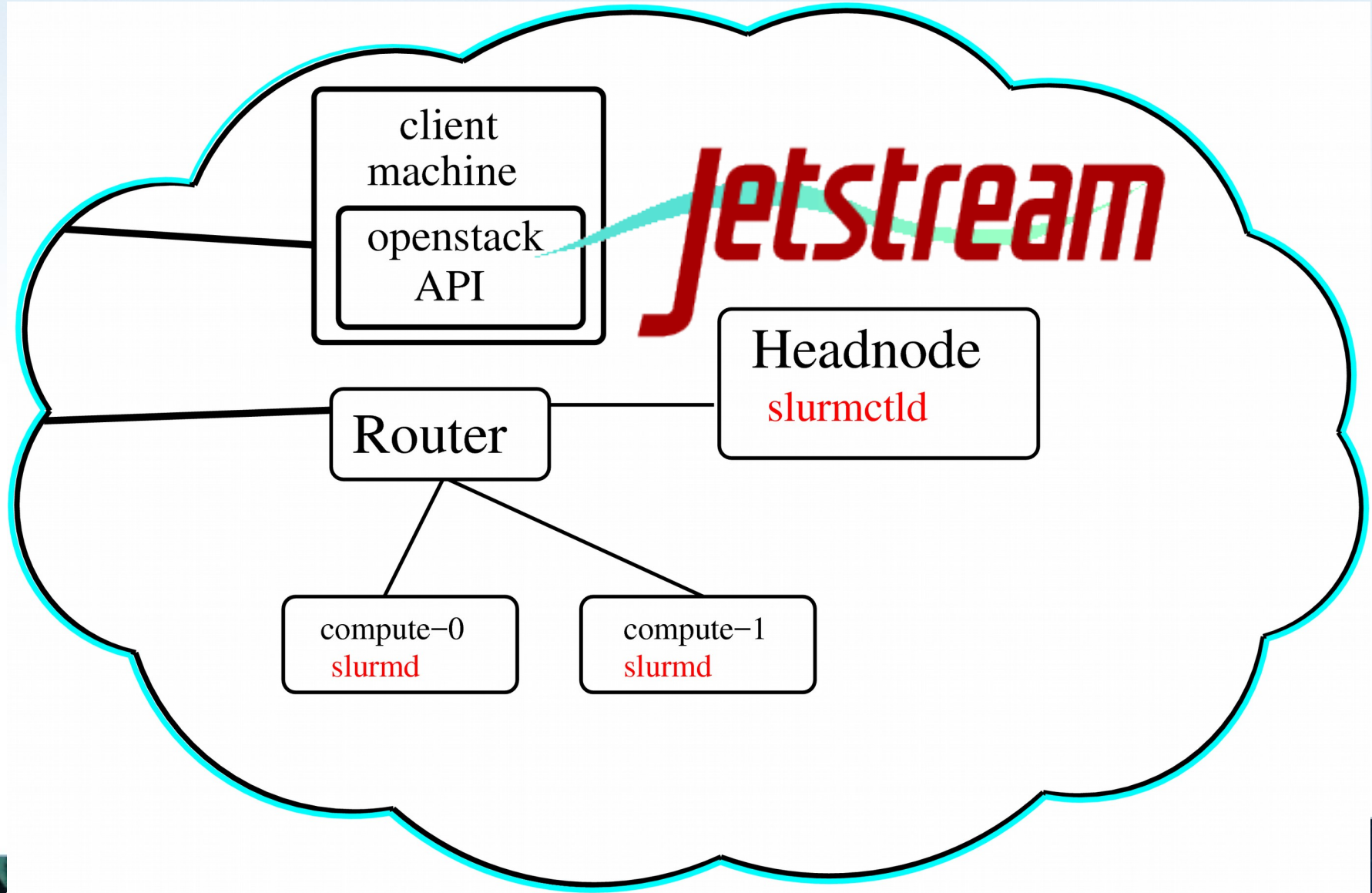
Using Jetstream from the inside:



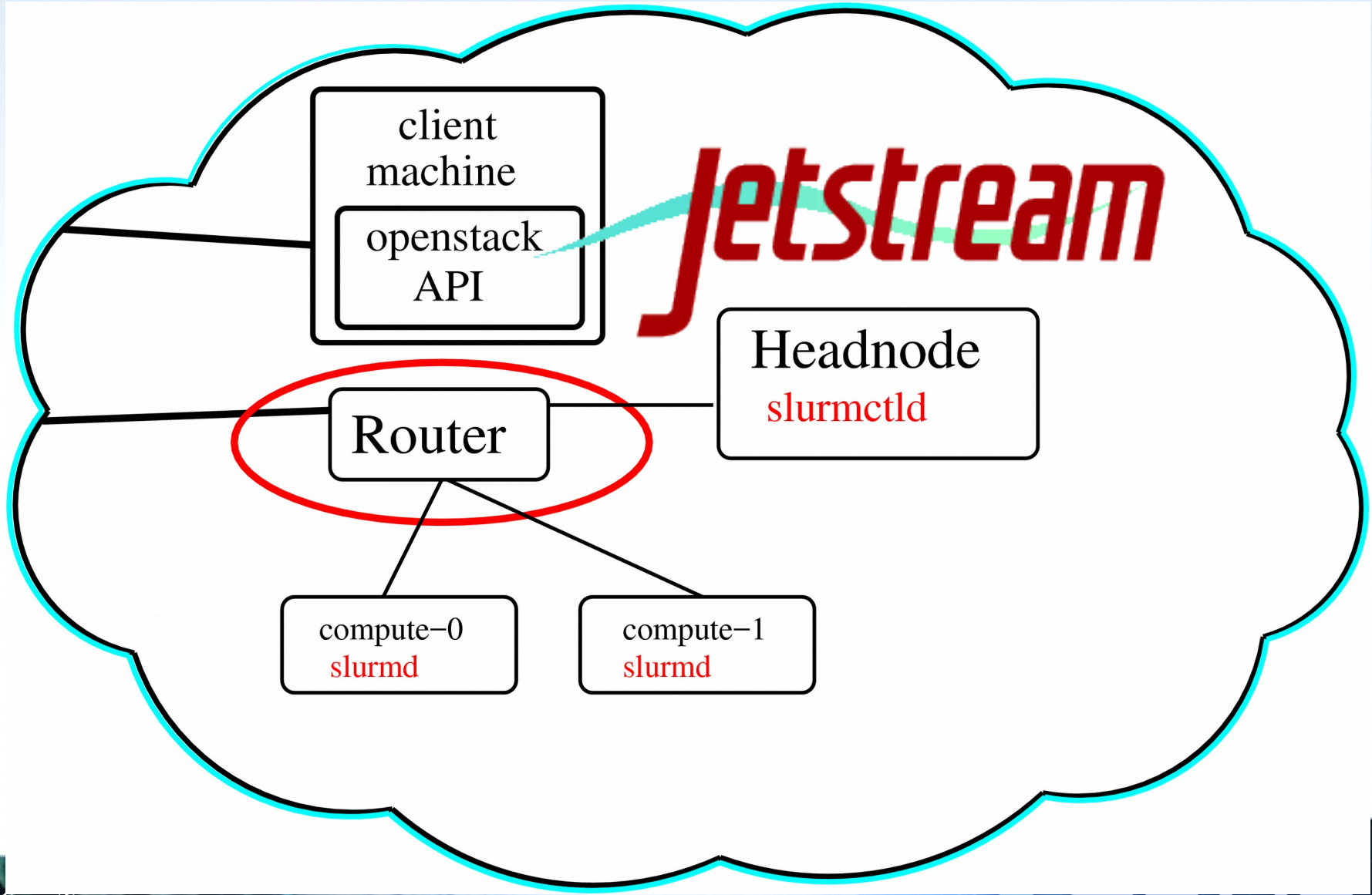
We only need two compute nodes!



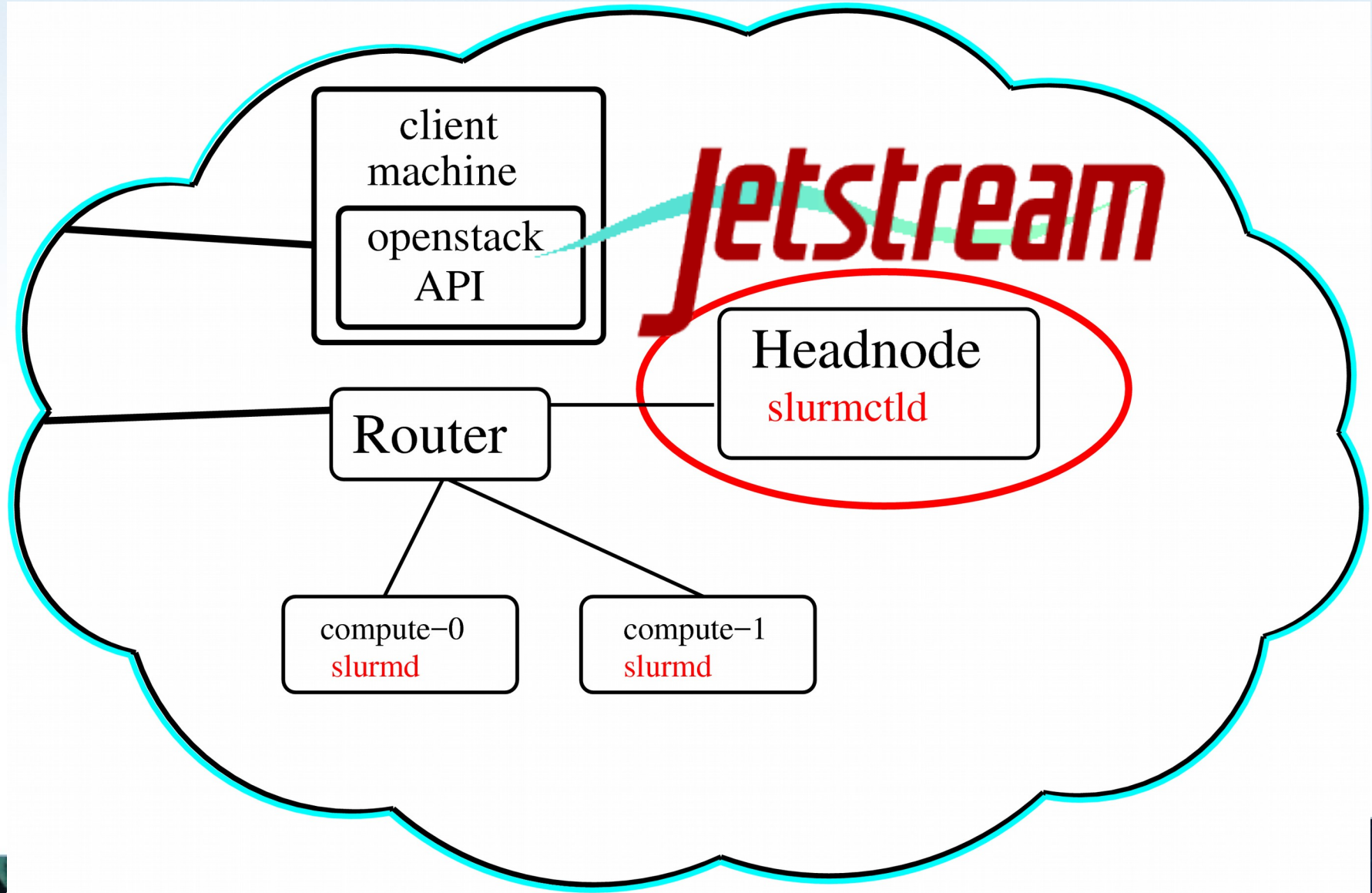
Final state:


client
machine
openstack
API
Jetstream
Headnode
slurmctld
Router
compute−0
slurmd
compute−1
slurmd

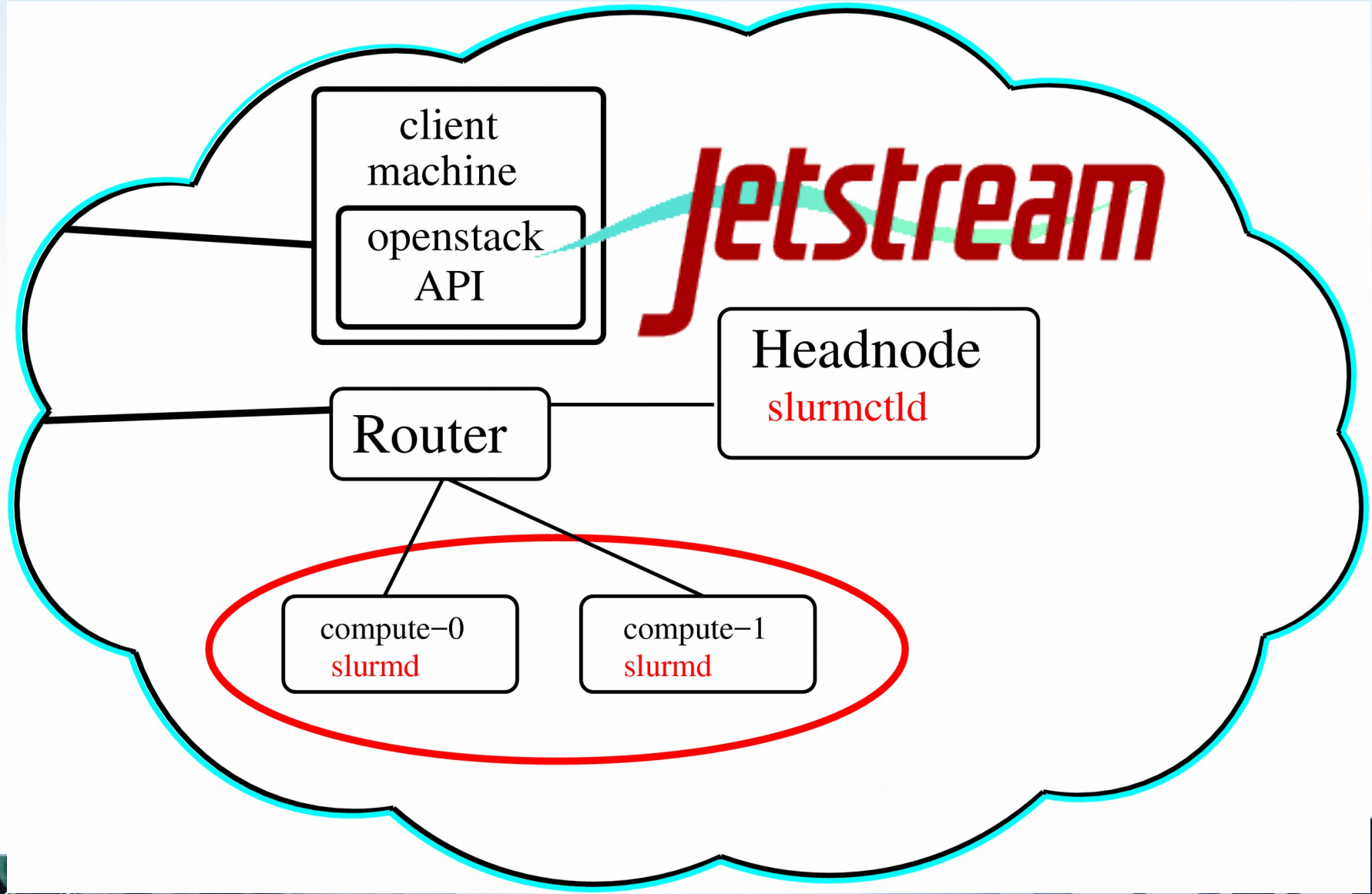
First, create the router/network:



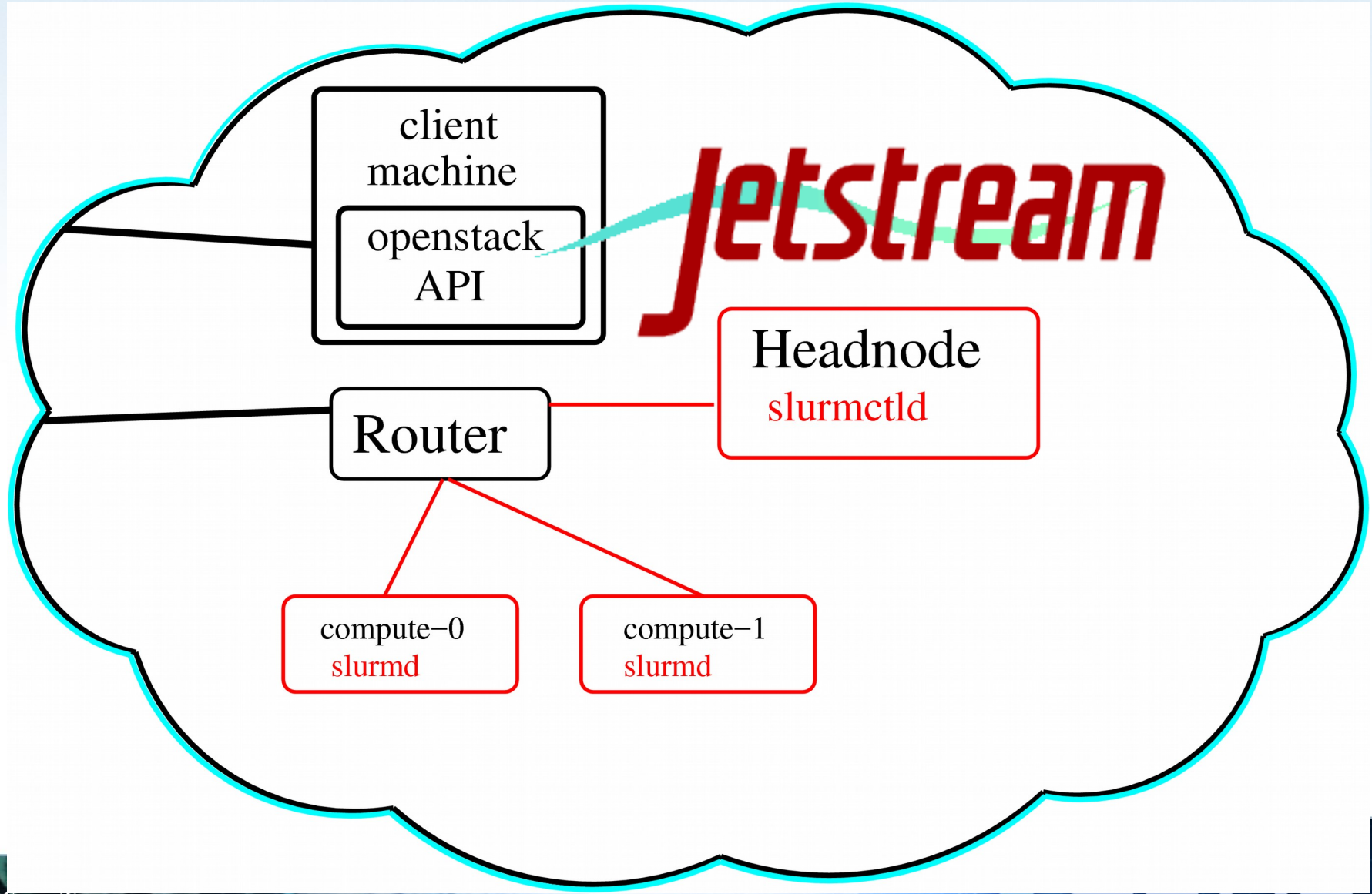
Now, create the headnode:



Now, create the compute nodes:



Now, configure the scheduler (etc.)!



Where can I get help?

Wiki / Documentation: http://wiki.jetstream-cloud.org

User guides: https://portal.xsede.org/user-guides

XSEDE KB: https://portal.xsede.org/knowledge-base

Email: help@xsede.org

Campus Champions: https://www.xsede.org/campus-champions

Training Videos / Virtual Workshops (TBD)

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Let’s get started!

https://goo.gl/FmoHZ5